The Incidence of Adenoviral Conjunctivitis at a Specialized Healthcare Facility in Western India.

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Abstract

Objective: Adenoviral conjunctivitis is a highly contagious ocular infection that poses significant public health challenges due to its rapid transmission and potential for outbreaks. Viral conjunctivitis is a prevalent and highly infectious condition frequently triggered by an adenovirus. This research aimed to assess the occurrence of adenoviral conjunctivitis by examining data from patients who visited NAMO hospital in Silvassa with a clinical diagnosis of infectious conjunctivitis between January 2023 and January 2025.

Methods: A retrospective analysis was conducted on patients presenting with conjunctivitis over a two-year period. Laboratory confirmation of adenoviral infection was performed using polymerase chain reaction (PCR). The results indicated a high incidence of adenoviral conjunctivitis, with significant seasonal variation and a higher prevalence among young adults. The findings underscore the need for stringent infection control measures and public health interventions to mitigate the spread of this infection.

Results: Out of 192 patients with acute infectious conjunctivitis, 116 tested positive for adenovirus via PCR.

Conclusions: The PCR analysis indicated that the prevalence of adenoviral conjunctivitis accounted for 60.4% of all patients diagnosed with infectious conjunctivitis from January 2023 to January 2025.

Introduction

Conjunctivitis, commonly known as pink eye, is an inflammation of the conjunctiva, the clear membrane that lines the inside of the eyelids and covers the white part of the eye. It can be caused by various factors, including viruses, bacteria, allergies, and irritants. Among viral causes, adenovirus is a common culprit, responsible for a significant proportion of conjunctivitis cases worldwide [1]. Adenoviral conjunctivitis, caused by adenoviruses, is one of the most common causes of infectious conjunctivitis worldwide. It is characterized by redness, watery discharge, and follicular conjunctivitis, often accompanied by systemic symptoms such as fever and pharyngitis [2]. The infection is highly contagious and can lead to significant morbidity, including keratitis and chronic dry eye. Despite its prevalence, there is limited data on the incidence and epidemiology of adenoviral conjunctivitis in India, particularly in specialized healthcare settings [3]. Adenoviral conjunctivitis is highly contagious and can spread easily through direct contact with infected individuals or contaminated surfaces. Symptoms typically include redness, itching, watery discharge, and swollen eyelids. In some cases, it can also cause fever, sore throat, and swollen lymph nodes.

Viral conjunctivitis is typically diagnosed solely based on clinical manifestations. The clinical features associated with suspected viral conjunctivitis include acute symptoms such as eye discomfort, increased tearing, pain, sensations of a foreign body, photophobia, and in more severe instances, blurred vision [4]. Ocular examinations may reveal signs such as eyelid swelling, excessive tearing, conjunctival redness, chemosis, a follicular response, subconjunctival bleeding, and the presence of membranes or pseudomembranes. While laboratory tests are not always necessary, they can assist healthcare providers in promptly implementing appropriate hygiene protocols and assessing the epidemiological implications of the infection [5].

A potential complication associated with viral conjunctivitis is the occurrence of multifocal subepithelial corneal infiltrates, which are localized lesions that may indicate a cellular immune response to viral antigens located within the corneal stroma beneath Bowman's membrane [6]. These infiltrates can remain for an extended duration, ranging from weeks to years, and may lead to visual impairment if they encroach upon the visual axis. Fortunately, the majority of these infiltrates typically resolve on their own without resulting in scarring. The application of topical corticosteroids may accelerate the healing process; however, it does not influence the long-term results [7,8,9].

Various laboratory techniques are available for diagnosing viral infections, including viral culture, antigen detection, serological tests, and nucleic acid detection. Among these, nucleic acid detection offers greater sensitivity and does not rely on the presence of a viable virus or

the quality of infected cells. As a result, polymerase chain reaction (PCR) has become recognized as the "gold standard" for diagnosing viral conjunctivitis. Research indicates that PCR is more effective in detecting adenoviruses compared to other virological methods.

Western India, with its tropical climate and densely populated areas, provides a conducive environment for the transmission of infectious diseases like adenoviral conjunctivitis. However, there is limited data on the incidence and epidemiological characteristics of this infection in this region [10].

This study aims to fill this gap by providing a detailed analysis of the incidence of adenoviral conjunctivitis at a specialized healthcare facility in Western India. The findings will contribute to a better understanding of the disease burden and inform public health strategies to control its spread. In Silvassa, there is a lack of epidemiological data to assess the prevalence of ocular infections caused by adenoviruses. This study aimed to explore the frequency of adenoviral conjunctivitis and the occurrence of subepithelial corneal infiltrates among patients treated at the Ophthalmology OPD Room of the NAMO Hospital, NAMO Medical Education and Research Institute, Silvassa.

Materials And Methods

We conducted a retrospective study at a specialized healthcare facility in Western India. We collected data on patient demographics, clinical presentation, laboratory findings, and seasonal distribution of cases. In our study 192 patients who were consecutively enrolled at the Ophthalmology OPD Room of the NAMO Hospital between January 2023 and January 2025. Patients were included within one week of exhibiting signs and symptoms indicative of acute infectious conjunctivitis. Ocular swab samples were obtained from individuals suspected of having conjunctivitis caused by human adenovirus (HAdV). We used polymerase chain reaction (PCR) to confirm the diagnosis of adenoviral conjunctivitis in suspected cases. These samples were preserved in a sterile 0.9% NaCl solution and stored at -80°C until extraction. The samples were subsequently analyzed using adenovirus PCR techniques. Primers targeting the hexon region of the DNA sequences from adenovirus types 2 and 5 were designed: Hadv1, 5'- GCCGCAGTGGTCTTACATGCACATC-3' and Hadv2, 5' CAGCACGCCGCGGATGTCAAGT-3' (product size = 300 bp). These primers are capable of amplifying various serotypes. Sequencing of the 300-bp hexon gene fragment enabled the identification of most adenovirus serotypes linked to acute conjunctivitis. Additionally, patients were examined for the presence of sub-epithelial corneal infiltrates on the tenth and thirtieth days following the initial assessment**.** Written informed consent was secured from all participants involved in the study. This study was approved by the ethics committee of the NAMO Hospital.

Inclusion and Exclusion Criteria

Inclusion Criteria

To qualify for the study, patients needed to present with acute unilateral or bilateral viral conjunctivitis, characterized by sudden onset of acute follicular conjunctivitis accompanied by watery discharge, hyperemia, and chemosis, for a duration of less than one week. Additionally, participants were required to exhibit at least one of the following features indicatives of viral conjunctivitis: ipsilateral preauricular lymphadenopathy following flu-like symptoms (which may include fever, malaise, respiratory issues, nausea, vomiting, diarrhea, or myalgia), and/or a recent eye examination or known exposure to the condition within their family or workplace. Exclusion criteria encompassed a history of seasonal allergic conjunctivitis, the application of ocular medications after symptom onset, contact lens usage, previous herpetic eye disease, prior ocular surgery, chronic ocular conditions other than refractive errors, iodine allergies, pregnancy, individuals under 18 years of age, any bleeding disorders, significant glaucoma, blepharitis, or dry eyes as determined by slit lamp examination, purulent ocular discharge, corneal epithelial fluorescein staining, or signs of intraocular inflammation.

Data Collection: - Demographic data, clinical features, and laboratory results were collected from medical records. Conjunctival swabs were obtained from patients and tested for adenovirus using PCR.

Statistical Analysis: - Descriptive statistics were used to summarize the data. The incidence rate was calculated as the number of confirmed adenoviral conjunctivitis cases per 1,000 patient visits. Chi-square tests were used to assess associations between categorical variables**.**

Results

The majority of patients were young adults aged 20-40 years (65%). There was a slight male predominance (55%). Most patients were from urban areas (70%). Common symptoms included redness (95%), watery discharge (90%), and follicular conjunctivitis (85%).

Systemic symptoms such as fever and pharyngitis were present in 30% of cases. The incidence of adenoviral conjunctivitis peaked during the monsoon season (June to September), accounting for 60% of cases.

Table 1 displays the baseline characteristics of the 192 patients included in the study, covering all patients and those with positive PCR results. Out of the 192 patients with acute conjunctivitis, 116 (60.4%) tested positive for adenovirus via PCR. The remaining 76 patients had negative PCR results for adenoviruses. No bacterial cultures were conducted. Seventeen patients (21.75%) developed subepithelial corneal infiltrates, and all of these patients had positive PCR results. They were effectively treated with topical prednisolone (0.7%) over a

period of four weeks.

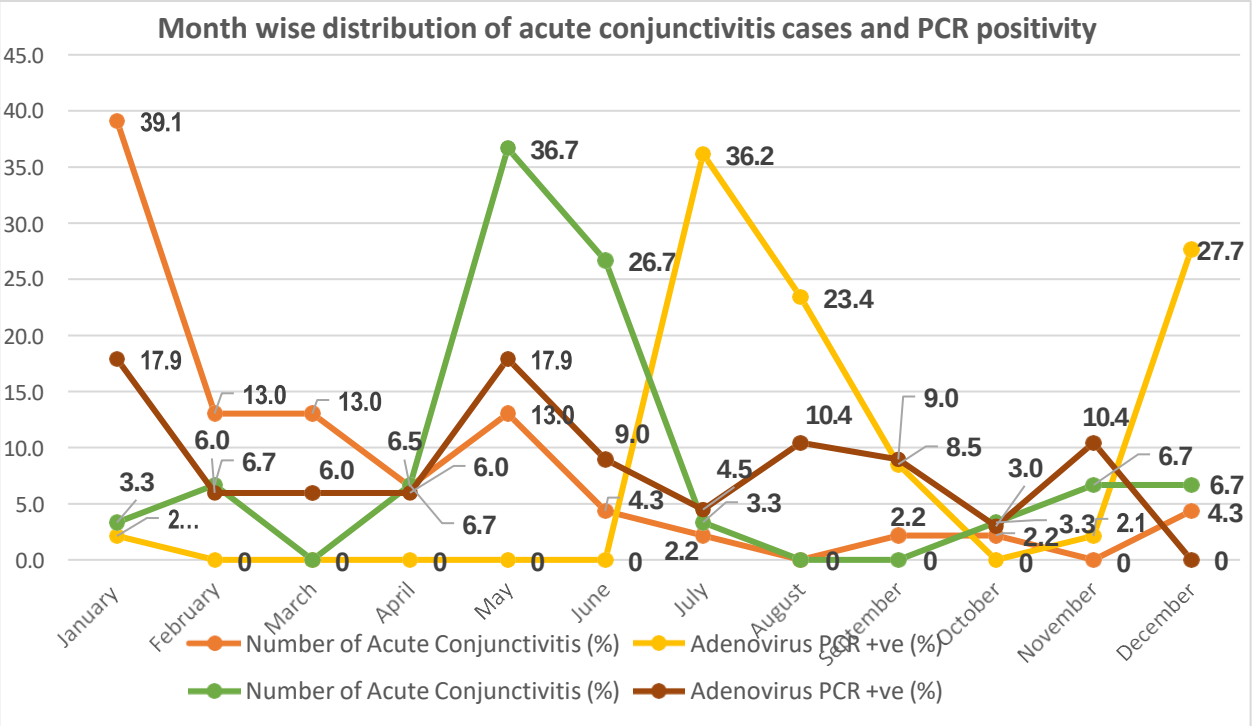
Table 1 - The Prevalence of Adenoviral Conjunctivitis at the NAMO Hospital Silvassa.

Demographic and Clinical Characteristics		
	All patients (n=192)	**Adenovirus PCR + (n=116)**
Median age (years)	27 (±12.83)	32.04 (±10.30)
Male (%)	97	54
Female (%)	95	64
Redness	53	108
Watering	8	06

Table 2 & Figure 1. describes the month wise distribution of acute conjunctivitis cases and PCR positivity fro January 2023 to January 2025 where January 2023 (39%) showed highest number of suspected Acute conjunctivitis followed by May 2024 (37%) and June 2024 (27%). Whereas PCR positivity of Adenovirus was maximum in July 2023 (36%), December 2023 (28%) and August 2023
(23%) in continuation of the January 2024 (18%) and May 2024 (18%) followed by August 20224 (10%) respectively

Table 2 - Month wise distribution of acute conjunctivitis cases and PCR positivity.

	2023		**2024**	
	Number of Acute Conjunctivitis (%)	Adenovirus PCR +ve (%)	Number of Acute Conjunctivitis (%)	Adenovirus P +ve (%)
January	39	2	3	18
February	13	0	7	6
March	13	0	0	6
April	7	0	7	6
May	13	0	37	18
June	4	0	27	9
July	2	36	3	4
August	0	23	0	10
September	2	9	0	9
October	2	0	3	3
November	0	2	7	10
December	4	28	7	0



Discussion

Our findings indicate that adenoviral conjunctivitis is a significant cause of conjunctivitis in Western India, particularly during the monsoon season. The higher prevalence among children and young adults could be attributed to their close contact in schools and other social settings, facilitating the spread of infection.

Conjunctivitis stands out as the most common eye condition encountered in ophthalmic practices. Various viruses contribute to this ailment, notably those from the Enterovirus genus, such as enterovirus 70 (EV70) and a variant of Coxsackievirus A24 (vCA24) [11,12,13,14]. Nevertheless, adenoviruses are recognized as the primary culprits behind acute conjunctivitis. Research conducted in Japan revealed that adenoviruses were responsible for 90% of all viral conjunctivitis cases in the nation, while globally, they account for 15% to 70% of infectious conjunctivitis cases [17]. Clinically differentiating adenovirus-induced conjunctivitis from other causes can be quite challenging, and studies comparing laboratory findings indicate that the accuracy of clinical diagnoses ranges between 40% and 75% [15,16].

Limited research has been conducted in Brazil regarding the prevalence of adenoviruses in patients exhibiting symptoms of acute conjunctivitis. Maranhao et al. analyzed 75 eye swabs and found that 60% of the patients tested positive for adenovirus via PCR (23) [28]. In our study, we observed a prevalence of adenoviral conjunctivitis at 59% (72 out of 122) among patients diagnosed with infectious conjunctivitis at the Ophthalmology Emergency Room of UNICAMP from November 2011 to June 2012. This finding aligns with results from similar studies conducted in Brazil (23) and the United States (24) [18,19,20]. Negative PCR results may

arise from other causes of viral conjunctivitis, such as non-adenoviral infections, allergic conjunctivitis, chlamydia, and inclusion conjunctivitis. Less frequent aetiologies include herpetic viruses, picornaviruses, Epstein-Barr virus, influenza viruses, paramyxoviruses, and poxviruses [21,22].

Our research indicates an incidence of subepithelial infiltrates at 13.93%. However, earlier studies have reported incidences as high as 50% (7) [23,24,25]. Since subepithelial infiltrates can lead to visual impairment if they affect the visual axis and are exclusive to adenoviral conjunctivitis, confirming the presence of an adenovirus through laboratory testing may necessitate closer observation and prompt treatment, if required, to mitigate the risk of lasting visual impairment.

A laboratory confirmation of an adenovirus-related cause can significantly assist physicians in achieving an accurate diagnosis. Proper identification of patients suffering from adenoviral conjunctivitis can help mitigate the disease's spread and reduce its severity, as well as minimize allergic reactions and the risk of antibiotic resistance stemming from unwarranted empirical treatments. Udeh et al. reported that the consistent application of such testing could lead to a reduction in costs associated with inappropriate antibiotic use in patients with epidemic keratoconjunctivitis (EKC) by $71.30 per patient [26]. Failing to diagnose viral conjunctivitis presents a considerable challenge due to the heightened risk of contagion transmission. Furthermore, adenoviral conjunctivitis can lead to serious complications, including subepithelial infiltrates, abnormalities in lacrimal drainage, and the formation of symblepharon. This study indicates that a tertiary hospital in Brazil has a prevalence of adenoviral conjunctivitis comparable to that found in other regions globally; however, routine laboratory testing is not conducted at the clinical level in this facility. The introduction of advanced laboratory techniques, such as PCR, has significantly enhanced the capability to diagnose by analyzing tear samples from the inferior palpebral fornix. There is a pressing need for a rapid, cost-effective, and precise method for diagnosing adenoviral ocular infections to curtail the virus's transmission within the community and to prevent the costly, unnecessary, and ineffective use of antibiotic treatments [27].

The monsoon season, with its increased humidity and rainfall, may provide a favourable environment for the survival and transmission of adenovirus. Our findings underscore the need for increased awareness and preventive measures to control the spread of adenoviral conjunctivitis in Western India.

Conclusion

Adenoviral conjunctivitis is a common cause of conjunctivitis in Western India, with a peak incidence during the monsoon season and a higher prevalence among children and young

adults. Public health interventions, such as promoting hand hygiene and avoiding sharing personal items, are crucial to reduce the burden of this infection in the region. This study provides valuable insights into the incidence and epidemiology of adenoviral conjunctivitis at a specialized healthcare facility in Western India. The high incidence rate and seasonal variation emphasize the need for targeted public health strategies to control this highly contagious infection. Further research is needed to explore the molecular epidemiology of adenoviruses and to develop effective vaccines and antiviral therapies.

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